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EXAMINER

FOONG, SUK SAN

ART UNIT PAPER NUMBER

2823

DATE MAILED: 01/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/033,694

Applicant(s)

SALVATORE, LEONARDI

Examiner

Suk-San Foong

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-19, 21 and 23-41 is/are rejected.
- 7) ☒ Claim(s) 10, 20 and 22 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) ____.
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claim 17 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The “before said active area defining step” is a labeling step which is not an actual process step. (Refer to 35 U.S.C. 112 paragraph 2 rejection of claim 1 below).

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 6 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is lack of written description in original claim (1242 OG 168); wherein the etching back step removes the bird's beak structure.

4. Claims 23-26 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had

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possession of the claimed invention. There is no description in the specification as originally filed of etching the nitride layer in field regions other than etching a further deposited nitride layer away from field regions. (1242 OG 168, p. 172).

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-37 and 39 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Claims 1 and 39, it appears that lines 13-14 and 14-15, respectively, is merely a labeling step and should be deleted because they do not recite a manipulative process step.

8. Claim 2, it is questioned what is recited through the use of "it".

9. Claim 13, 14 and 25, it is questioned what is recited through the use of "enhanced".

10. While applicant may be his or her own lexicographer, a term in a claim may not be given a meaning repugnant to the usual meaning of that term. See *In re Hill*, 161 F.2d 367, 73

USPQ 482 (CCPA 1947). The term "deep" in claims 13, 14 and 25 is used by the claim to mean "surface implant," while the accepted meaning is "implanted region below substrate surface."

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11. Claims 14 and 25, it is unclear what is recited through the term "convenient".
 12. Claims 18 and 20, lines 3 and 1, respectively, recites the limitation "said additional nitride layer" in lines 3 and 1, respectively. There is insufficient antecedent basis for this limitation in the claim. It appears that "additional" should be replaced by--further--.
 13. Claim 25, it appears that "13" should be replaced by--23--and the claim has been so treated for the purposes of this Office Action.
 14. Claim 29, it appears that after "dielectric trench", the term--further--should be inserted.
 15. Claims 31 and 35, it is questioned what is recited through the term "thin".
 16. Claim 32, it is unclear what function or what degree of function is recited through "proper".
 17. Claim 38 recites the limitation "the SOI" in line 2. There is insufficient antecedent basis for this limitation in the claim.
 18. Claim 40 recites the limitation "the SOI" in line 2. There is insufficient antecedent basis for this limitation in the claim.
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19. Claim 40 recites the limitation "the SOI" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

20. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

21. Claims 1-8, 13, 31, 32 and 36-38 are rejected under 35 U.S.C. 102(b) as being anticipated by Sugisaka et al. ('722).

Sugisaka et al. teaches a method of forming trench isolation junctions on SOI substrate in a semiconductor device which includes forming oxide layer 8a by thermal oxidation on silicon substrate 3 (Col. 3, lines 50-51, and Fig. 2), then forming nitride layer 9 on oxide layer 8a (Col. 3, line 52) where an optional silicon dioxide layer 10 can be formed over nitride layer 9 (Col. 3, lines 52-53), then performing a photolithographic process through the use of a photoresist layer over nitride layer 9 for forming at least one dielectric trench (Col. 3, lines 65-67), then etching through nitride layer 9 and oxide layer 8a to form opening 11 as masked by photoresist (Col. 4, lines 2-7, and Fig. 4), then removing the photoresist layer (Col. 4, lines 6-7), subsequently etching substrate 3 at openings 11 to form trenches 12 such that trenches 12 are contacting buried oxide layer 2 and, thus, using nitride layer 9 as a hardmask layer (Col. 4, lines 8-14, and Fig. 5), then performing an oxidizing step on sidewalls of trenches 12 (Col. 4, lines 33-35), subsequently

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filling trenches 12 with filling material 14 thereby plugging up trenches 12 (Col. 4, lines 35), then planarizing filling material 14 by etching back filling material 14 (Col. 4, lines 43-48 and 56-59), subsequently performing an oxidation step to form oxide layer 15 over surface of filling material 14 (Col. 4, line 66 to Col. 5, line 1, and Fig. 6), then removing nitride layer 9 (Col. 5, line 2, and Fig. 7), then implanting through oxide layer 8a to form well regions 6 within dielectric trench regions (Col. 5, lines 6-8) thereby placing oxidized walls of trenches 12 in direct contact with at least one doped surface layer (Fig. 8), subsequently forming a further nitride layer over specified locations of substrate 3 and at field regions (Col. 5, lines 9-13, and Fig. 8), then performing an oxidization process to form field oxide layer over the field regions where a second plurality of bird's beak structures at edges of field regions is formed (Col. 5, lines 15-24, and Fig. 8), then removing the further nitride layer (Col. 5, lines 16-17), subsequently removing oxide layer 8a (Col. 5, line 43), then forming pre-implantation oxide layer (Col. 5, line 43-44), and subsequently forming doped regions 17 and 18 by doping in between trench isolations or wells (Col. 5, lines 46-47).

In regard to claim 5, the recited step would be obtained as the same materials are being treated the same as the instant invention.

Claim Rejections - 35 USC § 103

22. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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23. Claims 9, 11, 12, 27-30, 39 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugisaka et al. ('722) as applied to claims 1-8, 13, 31, 32 and 36-38 above, and further in view of Nishizawa et al. ('875).

Sugisaka et al. does not disclose doping the trench filling material.

Sugisaka et al. does not disclose oxidizing step to form pre-implantation oxide layer.

Nishizawa et al. teaches a method of forming trench dielectrics for integrated circuits which includes providing SOI substrate 13 (Col. 5, lines 33-40, and Fig. 1A), then forming a thin oxide film over substrate 13 (Col. 5, lines 46-47), subsequently depositing and patterning photoresist film on the thin oxide film (Col. 5, lines 53-56), then forming trenches 20 down to buried oxide layer 12 (Col. 5, lines 41-45, and Fig. 1B), then removing the patterned photoresist film and the thin oxide film (Col. 6, lines 3-7), subsequently performing an oxidation step to grow a further oxide layer 30 on trenches 20 sidewalls and substrate 13 (Col. 6, lines 8-16, and Fig. 1C), then filling trenches 20 with filling material 40 (Col. 6, lines 22-27, and Fig. 1D), subsequently removing oxide layer 30 at surface of substrate 13 by using filling material 40 as a mask (Col. 6 lines 33-36, and Fig. 1D), then doping filling material 40 by ion-implants I (Col. 6, lines 52-55, and Fig. 1E), subsequently forming oxide layer 50 over trenches 20 and pre-implantation oxide layer 41 on surface of substrate 13 (Col. 7, lines 6-16, and Fig. 1F), subsequently performing enhancement implanting step on the surface substrate 13 prior to removal of pre-implantation oxide layer 41 (Col. 7, lines 23-28, and Fig. 1G),

It would have been within the scope to one ordinary skill in the art to combine both the teachings of Nishizawa et al. with Sugisaka et al. because it would enable formation of trenches 12 of Sugisaka et al. to be performed.

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It would have been within the scope to one ordinary skill in the art to combine teachings because it would enable formation of pre-implantation oxide layer of Sugisaka et al. to be performed.

Examiner takes official notice that in situ doping of filling material during trench filling was known at the time of applicant's invention.

It would have been within the scope to one ordinary skill in the art to combine the known teachings with the combination process because it would enable formation of trenches 12 of Sugisaka et al. to be performed.

24. Claims 14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugisaka et al. ('722) as applied to claims 1-8, 13, 31, 32 and 36-38 above, and further in view of Yamamoto et al. ('270).

Sugisaka et al. does not teach the steps as recited in claim 14 and 17.

Yamamoto et al. teaches a method of forming doped regions in semiconductor substrate which includes forming masking resist film 51 over substrate 1 (Paragraph [0040], and Fig. 3K), subsequently forming openings at locations where doped regions are to be formed in substrate 1, then implanting through openings and subsequently annealing implanted regions 5 (Fig. 5L).

It would have been within the scope to one ordinary skill in the art to combine both teachings because it would enable formation of doped regions 17 and 18 or Sugisaka et al. to be performed.

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25. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugisaka et al. ('722) as applied to claims 1-8, 13, 31, 32 and 36-38 above, and further in view of Park et al. ('310).

Sugisaka et al. does not teach the steps as recited in claims 15 and 16.

Park et al. teaches a method of forming dielectric isolation regions which includes forming oxide layer 14 over substrate 10 (Col. 4, lines 40-50, Fig. 1A), then forming photoresist mask with openings 18 over oxide layer 14 (Col. 4, lines 55-57), subsequently forming trench 20 (Col. 4, lines 65-68, and Fig. 1B), then removing oxide layer 14 (Col. 5, lines 9-11), then oxidizing sidewalls of trench 20 thereby forming oxide layer 22 (Col. 5, lines 11-18), subsequently filling trench with filling material 24 (Col. 5, lines 23-25, and Fig. 1C), then forming silicon nitride layer 32 over substrate 10 (Col. 5, lines 65-68), then forming masking resist layer 34 over substrate with opening 36 trench 20 wherein portion of masking resist layer 34 is removed (Col. 6, lines 1-5, and Fig. 1G), then removing exposed portions of silicon nitride layer 32 (Col. 6, lines 6-11), then forming photoresist layer 38 over a portion of masking resist layer 34 and trench 20 (Col. 6, lines 12-21, and Fig. H), subsequently implanting through opening 40 thereby forming doped region 42 (Col. 6, lines 21-25, and Fig. 1H), subsequently removing photoresist layer 38 and masking resist layer 34 and a portion of oxide layer 22 over trench 20 (Col. 6, lines 25-27), then forming bird's beak structure 44 (Col. 6, lines 29-36), and subsequently removing silicon nitride layer 32 and oxide layer 22 (Col. 6, lines 37-42, and Fig. 1K).

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It would have been within the scope to one ordinary skill in the art to combine both teachings because it would enable formation of doped regions 17 and 18 of Sugisaka et al. to be performed.

26. Claims 18, 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugisaka et al. ('722) as applied to claims 1-8, 13, 31, 32 and 36-38 above, and further in view of Wolf.

Sugisaka et al. does not disclose the steps of photomasking and etching the further nitride layer at locations of field regions.

Wolf teaches forming nitride layer over pad oxide layer formed on semiconductor substrate, then performing a photolithographic step at locations of field regions, subsequently etching nitride layer and oxide layer at defined field regions, and then performing an oxidation step to form field oxide layer with bird's beak structure (p. 20-22, and Fig. 2-6).

It would have been within the scope to one ordinary skill in the art to combine the teachings of Wolf with Sugisaka et al. because it would enable formation of field oxide layer of Sugisaka et al. to be performed.

27. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sugisaka et al. ('722) as applied to claims 1-8, 13, 31, 32 and 36-38 above.

The choice of etching ratio between the hardmask nitride layer and an oxide layer would have been a matter of routine optimization to achieve the desired device densities and the desired device characteristics of the device to be formed. (See MPEP 2144.05)

28. Claims 34, 35 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugisaka et al. ('722) as applied to claims 1-8, 13, 31, 32 and 36-38 above.

Sugisaka et al. does not disclose the step recited in claim 24.

Examiner takes official notice that coating a photoresist layer on surface of a semiconductor device and backetching the back side of the semiconductor device was known at the time of applicant's invention.

It would have been within the scope to one ordinary skill in the art to combine the known teachings with Sugisaka et al. because it would enable formation of semiconductor device of Sugisaka et al. to be performed.

Allowable Subject Matter

29. Claims 10, 20 and 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

30. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.


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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Suk-San Foong whose telephone number is 703-305-0383. The examiner can normally be reached on Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 (7724, 3431, 3432).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

sf
January 8, 2003


George Fourson
Primary Examiner
Art Unit 2823
